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hygiene based upon psychological principles, especially as the book is intended for normal and high school students. A few minor inaccuracies also and inadvertencies of expression might well receive attention in another edition; *e. g.*, on p. 33 it seems to be implied that imagination is dependent on changes of blood supply, on pp. 44-45 in considering giddiness the otolith organs are mentioned, but the semicircular canals are not, and on p. 50 the intensity of moonlight is taken much too high. The book is valuable enough, however, to carry off many more than these deficiencies, and will, no doubt, prove extremely helpful even to many above the level for which it was first designed.

E. C. S.

The Influence of High Arterial Pressures Upon the Blood-Flow Through the Brain. W. H. HOWELL. American Journal of Physiology, I. (1898), 57-70.

The physiology of the cerebral circulation is a difficult and obscure matter, and has been made even more difficult of comprehension by the supposition that, because the brain itself is practically incompressible and encased in an inextensible skull, any enlargement of the arteries under increased blood pressure must bring about a corresponding compression of the veins, which would hinder the outflow of the blood, and, in case of a sudden and great rise of arterial pressure, might produce anæmia by preventing it altogether. Recent experiments by several observers, however, have made clear that this reasoning was somewhere at fault, for when the arterial pressure in living animals has been made very high by the administration of drugs, the outflow has not been diminished. Prof. Howell has carried these experiments further, and, it would seem, entirely closed the question by showing in the case of dogs previously killed, that even very great pressures (*e. g.*, 500 mm. of mercury, or about 9.7 lbs. per square inch) do not cause any decrease of the outflow from the cerebral veins; in other words that "the circulation in the brain behaves in this respect precisely as it does in the other organs of the body; the greater the arterial pressure the more abundant is the flow of blood." The arterial enlargement is indeed compensated by compression of the veins (and they even show a pulse, due, apparently, to the increase of compression at each arterial pulse) but their total bore is considerably greater than that of the arteries, so that they are never seriously occluded, while the large sinuses, which might suffer more, are protected by tough dural sheaths.

E. C. S.

On the Relation Between the External Stimulus Applied to a Nerve and the Resulting Nerve Impulse as Measured by the Action Current. C. W. GREENE. American Journal of Physiology, I. (1898), 104-116.

Experiments were made on the excised nerves of frogs, terrapin, cats and dogs. The curves for the relation of the stimulating current and current of action, plotted from the results, show three stages: The first rising sharply from the abscissa and practically straight, the third also straight and nearly parallel to the abscissa, and the second, a curve with its concavity toward the abscissa, connecting the other two. The first stage extends from the smallest stimuli awakening any response up to the intensity required to bring out maximal muscular contractions and considerably beyond; it is the expression of an arithmetical ratio, each increase in stimulus bringing out a proportional and decided increase in the current of action. The third also represents an arithmetical ratio, but the increase for each unit of stimulus, while still proportional, is quite small. In the nerves of

dogs the author finds, as Waller found for the nerves of frogs, that the first straight portion of the curve is preceded by a short curved portion, convex toward the abscissa. The point of interest for psychophysics lies in the fact that, so far as inference from these experiments is justifiable, the relation of stimulus and sensation generalized by Weber's law (which many have considered a matter of neural physiology) lies in the activity of some other portion than the nerve fibre.

E. C. S.

The Functions of the Ear and the Lateral Line in Fishes. FRED-ERIC S. LEE. American Journal of Physiology, I. (1898), 128-144.

As a basis for discussing the relation of the ear and the organs of the lateral line Dr. Lee summarizes the results of his admirable studies on the equilibration sense and the ear, already published, together with others not as yet published in detail. The ear of fishes performs both dynamical and statical functions. The dynamical are: First, recognition of rotations (mediated by the semicircular canals and their nervous mechanisms), and second, recognitions of movements of translation (mediated by the otolith organs of the utricle, saccule and lagena). The statical function, recognition of position in space (gravity sense), is also mediated by the otolith organs. An ear might seem to imply hearing, but this is not the case in fishes,—Lee's experiments, like those of Bateson and Kreidl, showing these creatures to be without hearing in the ordinary sense of the word, though sensitive to jars.¹

Lee has also experimented on the lateral line organs in dog-fish, toad-fish and butter-fish with results that point strongly to an equilibrative function as that of these organs also, which agrees with the morphological derivation of the ear from a specialized group of these line organs.

What has probably been the evolutionary history of the developed ear of higher forms is thus sketched by the author: "The primitive function, not improbably, was the appreciation of movements of the water against the body and movements of the body in the water, combined with appreciation of contact, and, hence indirectly and crudely, of position in space; by the exercise of this function, through functional connection with the locomotor mechanism, the equilibrium of the body was maintained. In some unknown way a bit of this sensory system became cut off from the rest and enclosed within the skull; it still retained its power of appreciating bodily movements and contact, and this power became refined and differentiated; the capacity of appreciating rotary movements was separated from that dealing with progressive movements and position in space, and the two were associated with distinct organs, the semicircular canals on the one hand, and the otolith organs on the other, which were appropriately constructed to subserve their respective functions. Thus, a well-marked sensory organ for equilibrium was evolved in fishes. When aquatic animals began to leave the water and live a shorter or longer time upon the land, and the possible advantage of a sense of hearing was presented, a portion of this sensory organ of movement became still farther differentiated; a new patch of sensory nerve-terminations

¹ Lee summarizes one of Kreidl's studies as follows: "In a subsequent paper Kreidl explodes the oft-repeated tale of hearing by fishes that come for their food at the sound of a bell, by investigating carefully the action of trout at the famous old Benedictine monastery in Krems, Austria. He proved that the fishes come because they see the man who brings the food, and appreciate the vibrations of the water caused by his step and communicated through the stone basin; and that, when these are excluded, the sounds of the bell have no effect."